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COOPERATIVE EXTENSION WORK IN AGRICULTURE, AND HOME ECONOMICS.

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AN EFFECTIVE METHOD OF PREVENTING THE EROSION OF HILL LANDS.¹

TWIN PROBLEMS OF SOIL FERTILITY AND WATER CONTROL.

Twin problems of agriculture, probably of equal importance, are: (1) The maintenance of soil fertility and (2) water control. In the economic production of crops these two problems go together as the main factors. A certain degree of soil fertility and an adequate and properly controlled supply of water are necessary for profitable farming.

In the cotton-growing States a large percentage of the cultivated land has been allowed to decline in fertility, and much of it has reached the state where, in the ordinary phrase, it is termed "worn-out" land.

CAUSES OF WORN-OUT LAND IN THE SOUTH.

The rapid deterioration of the soils of the Southern States results from a number of causes. A few of the more important of these are: (1) Cheap lands, (2) natural conformation of the country, ranging from rolling to very hilly, (3) loose, loamy character of the soils, frequently with almost impervious subsoils, (4) long open winters with frequent torrential rains, combined with lack of humus in the soils and absence of winter cover crops, (5) shallow breaking of the soils and consequent lack of depth, (6) growing of clean-cultivated crops, which rapidly exhaust the humus of the soils, and (7) lack of any system of water control.

FORMS OF WATER CONTROL.

Water control as an agricultural problem takes different forms in different parts of the country and under varying conditions. In the arid regions it is solved by systems of irrigation combined with drainage. This is a most perfect form of water control in the production of crops. In regions of scant rainfall (less than 25 inches) the water supply is conserved carefully by methods of so-called dry farming.

¹ Most of the changes in the present revision of this circular have been suggested by State Agent Mason Snowden, of Louisiana, and are the result of his personal experience in the field. The cut and description of the wooden scraper for terrace building were furnished by J. A. Redhead, assistant State agent for Louisiana. See also Farmers' Bulletin No. 512.

In the Southern States water control is a question of handling a surplus amount of rainfall. In the level lands this becomes strictly a drainage proposition. In the hill lands terracing assumes paramount importance as a method of water control. Drainage is the removal of surplus water from the soil by ditches or tile, either through the soil or over the surface. Terracing provides a means of removing surplus surface or run-off water from the hill lands in such a manner as not to cause erosion of the soil.

CONSEQUENCES OF NEGLECT OF WATER CONTROL IN THE COTTON STATES.

The general neglect of water control on most of the cotton farms in the hill sections, where the greater part of the cotton crop is produced, has caused thousands of acres to be abandoned entirely. These lands have become so gullied and worn from bad treatment and heavy rains that their cultivation is no longer profitable. Owing to the sandy loam nature of the topsoil and the clay subsoil underlying it, after the not too abundant original supply of humus is gone the surface is carried by the heavy rains into the streams and deposited in the lowlands and river beds out of reach of cultivation. Much fertilizer which has been applied to supply the plant food is carried off in the same way before it reaches the plant roots. This waste accounts in part for the extensive use of fertilizers in some States. Although the poor plowing and unscientific methods of cropping have exhausted the humus so that lands once valuable are now worthless, farms usually can be restored to productiveness quickly and successfully by the right methods.

TERRACES.

As the cotton States become more densely populated and land values and wealth increase, the ultimate solution of water control on hill lands may be some system of tiling. At present the cost would be prohibitive, and therefore some method of hillside ditching or terracing must be used. Many of the best farmers in the South have found by actual experience that a combination of the hillside ditch and the terrace (fig. 1) will more nearly fill the needs of their lands than anything else yet tried. There are several methods of terracing and hillside ditching, each of which has some merits and some faults. However, the only two methods that will be discussed here are: (1) The broad-row terrace and (2) the Mangum terrace. Both of these terraces have "made good." They are built on the same principle, but are used in different cropping systems.

PRELIMINARY PREPARATION FOR TERRACING.

Before the best terracing can be done the rough places must be smoothed as much as possible, the washes filled, and the land plowed well, turning under a good supply of vegetable matter. A satisfactory

plan is as follows: Fill all the washes in the field to be terraced with straw, bagasse, or other litter that will hold and pack in well. Use stable manure on the eroded land around the washes. Plow as deeply as is safe to the washes as a center, and, if necessary, rake some dirt with hoes over the straw or litter. Sow thickly to oats, possibly as much as 2 to 4 bushels per acre. Rye also may be used. Do all this in the early fall. In disk ing or harrowing in the oats or rye, run the implements around the hills as nearly on a level as possible. These crops will grow all the winter, holding the soil and in large measure preventing washing. In May the crop may be harvested and should pay for the cost of the preparation of the field.



FIG. 1.—A field showing the combined hillside ditch and terrace.

Follow the oats with lespedeza. This may be sown in the growing crop in February or March, provided the land is suitable for lespedeza for either hay or pasture. If soil conditions are not favorable for lespedeza growing, plow the field as before and sow down to cowpeas broadcast, 2 bushels to the acre. After the peas or lespedeza are harvested for hay, the field is in first-class condition to terrace in the fall before the winter rains. Do not plow the land until after the terracing is done.

This is a very simple and economical way to get a badly washed field into condition for proper terracing. The crops produced should pay all expenses of preparation. It takes a year of time, but it can be made a part of the farm system of cropping. It is time well spent, for it is almost impossible to terrace a washed field accurately.

THE BROAD-ROW GRADED TERRACE.

In this method of terracing the terrace is laid off by the use of a level. (See p. 6.) A uniform fall of 4 to 8 inches in 100 feet should be allowed on steep lands and proportionately less on rolling lands. This must be changed to meet local conditions. Where the rainfall

is heavy, as in many parts of the South, the greater fall is needed. The distance between terraces is also governed by the steepness of the land. On average sloping lands the terraces should not be closer together than 60 to 80 feet from center to center. This will be about 3 feet apart on the perpendicular as read on the rod. On gently rolling lands with only slight tendency to wash the terraces can safely be 100 feet apart. The broad-row terraces need not be as close together as the narrow "hog-back" level terraces, for they are more efficient. On steep lands the terraces must be closer to keep the water from getting the least start. On such lands it would be better to make the terraces about 32 feet apart. Any land that requires terraces closer together than that to hold it in cultivated crops should be seeded to grass and used for pasture.

In beginning the work of terracing a field, the operator should start at the top of the hill, about where the first terrace is necessary.

In laying off the line for a terrace the operator should look for a good outlet. On hillsides that slope both ways it is advisable to carry the water in both directions, if outlets can be had. With areas of considerable size and where several depressions are to be gone through before reaching an outlet, it may be necessary to make a straight ditch at one of these natural depressions, carrying the water directly to the main outlet. This ditch will relieve the strain on the terrace and may save damage that would result from attempting to carry the water all one way by means of long, irregular terraces. Such ditches can be prevented from getting too deep by allowing grass to grow in them or by putting in brush occasionally. The main differences between this and other methods of terracing are in the construction of the dike or embankment and in the uses to which the embankment is put after it is completed. The construction is much easier and more economical than at first would be thought possible. The embankment can be made largely with the plow by lapping on the unbroken ground and throwing furrows toward the center until the desired width is obtained. The width will be governed by the ideas of the maker. A bank wide enough for three rows is preferred. Such a bank allows a center row on top of the embankment with another row on each side. After this bed has been thrown up once, go to the center, and then by lapping as before continue in the same manner until the proper height is reached. If a disk plow is used the embankment may be completed at the first operation, as it will turn loose dirt.

Obstructions will have to be removed, of course, depressions or gullies filled, and the bank at these points built up and strengthened to correspond with other parts of the terrace. The height as well as the width to which this embankment should be made depends on the depth of rainfall it must withstand. The one important feature is to make it strong enough to stand against any possible pressure.

When the embankments have been completed, run the rows parallel with them. Beginning with the first row on top of each dike, run off in pairs from each side, letting the short rows come in the middle. It has been found best to work in two short rows occasionally before finishing in order to prevent having all the short rows running out together, which would cause too great an accumulation of water at one point. The intervening short rows should always come in pairs, as this will allow teams to make a round without dragging the cultivator or plow out to the opposite end, as would necessarily be the case if there was only one row. The ends of all short rows should point slightly up grade. Opinion differs as to short rows—some prefer as above, while others prefer having them all come on one side or other. The rows on the terrace can be cultivated the same as the others, provided the terrace is made with the right grade and is broad enough. This method of terracing leaves no room for a crop of weeds, but utilizes all the land in the field. As each intervening row has some fall, the water will be carried out by it, but so slowly that the greatest amount possible will be taken up by the land before it can run off. Should enough water accumulate to run across the ordinary rows, the terrace rows will check and hold it until it can be gradually taken up by the land or carried slowly to the outlet. A little judgment in plowing will keep dikes from getting too high. No trouble is experienced in running cultivators, mowers, binders, or wagons on the terrace or across the field in any direction. There is no question that this method is better than any one yet used, and any farmer, it matters not how small his farm or limited his means, can practice it. Many of the best farmers in the sand-hill and light-loam sections of Mississippi, Louisiana, and Arkansas are handling their lands by this method.

The writer has had practical experience with all the methods ordinarily used in the past 25 years, and this method of drainage is far ahead of all other surface methods in efficiency of service and economy of construction. The main points are to plan the work properly at the start and to watch all weak places and keep them up, by hand if necessary. All except a small proportion of the construction can be done easily with plows. The scraper may be required in some low places, where sufficient dirt can not be thrown up by the plow.

This plan will be equally effective on pasture lands that have been turned out to be reclaimed. In fact, if they are terraced well and all the washing is checked, such lands will build up very much more rapidly than otherwise.

MANGUM TERRACE.

The Mangum system of terracing is practically the same as the broad-row graded system. The only difference between the two is in the filling in of the crop rows. With the Mangum terrace, built with a grade of 4 to 8 inches per hundred feet, the rows are ~~flat~~ in on

the level, crossing the terrace embankment at acute angles. This eliminates short rows. This system lends itself more readily to level cultivation with two-horse implements and fits in better with small grain farming. It does well on rolling lands. Its use can not be advised on steep lands or with tenants, for the reason that it is too difficult to keep up the terrace embankment with the rows crossing instead of paralleling it.

LEVELS FOR LOCATING TERRACES.

The lines of the terrace may be located with an engineer's level (fig. 2) or with one of the extensively advertised farm levels (fig. 3), which may be had for \$10 to \$15. If neither of these instruments is available, and the farmer does not feel able to invest in

one of them, he can, at a cost of \$2, make a substitute (fig. 4) that if carefully constructed and properly used will do satisfactory work and on very steep lands will answer even better. Take a piece of perfectly straight 1 by 3 inch lumber, 16 feet long. Nail to each end of this 16-

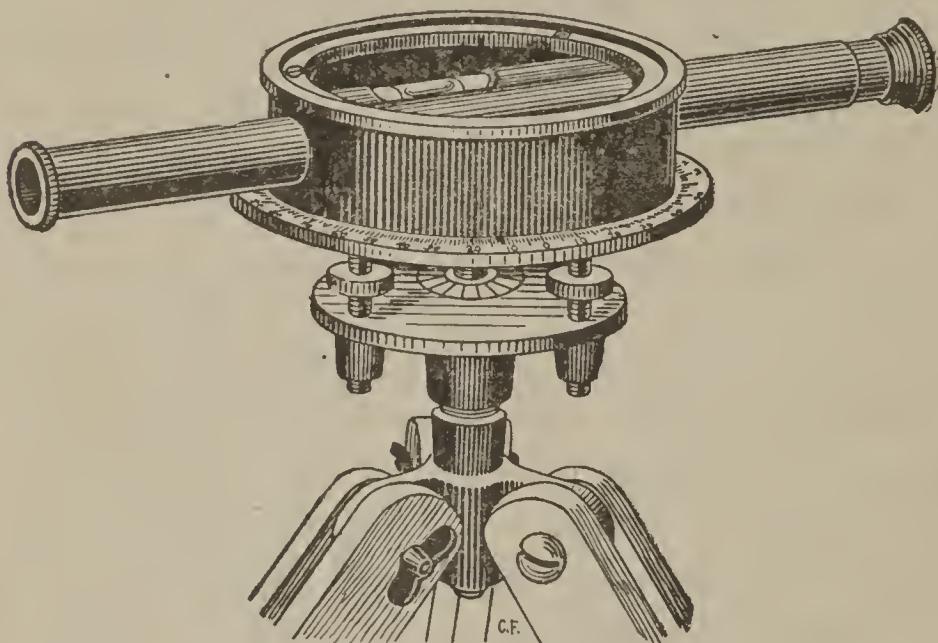


FIG. 2.—An engineer's level.

foot piece an upright piece 1 by 3 inches, $3\frac{1}{2}$ feet long, for legs, and then with two lighter pieces, one-half inch by 3 inches, put braces to extend from near the foot of each leg toward the center of the frame. Be sure that all joints are straight. Attach a 24-inch carpenter's level in the center. Test its accuracy at a level place by reversing the ends and making adjustments until both are alike. In using this level it will be found convenient to cut an inch off one leg or else tack a 1-inch block on one, to give proper fall to the terrace line. This gradient may be increased or decreased at will.

If properly used, the work of this cheap and simple outfit will be practically as good as that of a \$100 investment, but a greater amount of physical labor for the operator will attend its use.

USE OF THE HOMEMADE LEVEL.

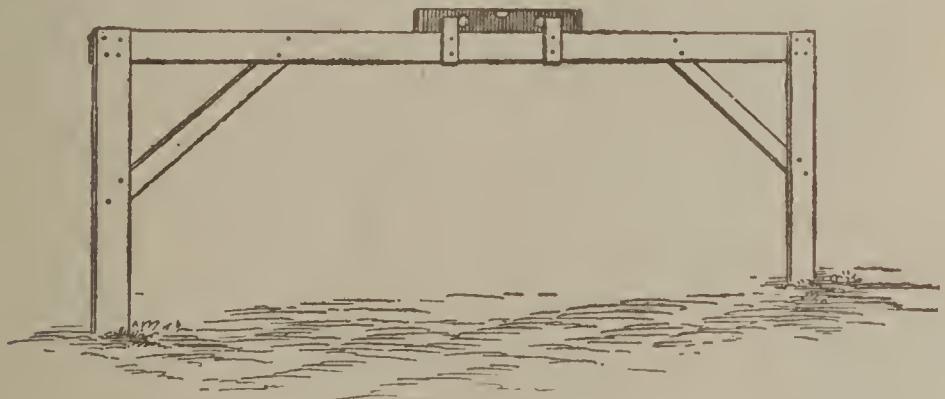
The use of leveling instruments probably is so well known that a description is unnecessary, but in order that all may know how to start from the base line with a frame level the details of its use are here given.

After locating the general outlet for surplus water, begin at a point nearest the top of the hill or ridge where the first terrace is to be established. Place the short-leg end of the level at the point of beginning with the other end in the direction which the line is to follow. Move the forward end up or down grade until the bulb shows level. Then mark the point of beginning by a stake or by digging with a hoe. Move the level forward, placing the back end on the spot where the forward end was; bring the bulb again to the center. Continue until the line is completed. Other lines may be run off in the same way.

Much time may be saved by using the hoe instead of a stake for marking, if the line is followed at once by the plow to mark it permanently. A little practice will enable the operator easily to locate the starting points and also to calculate the distances between terraces. After a little experience the operator will be able to judge by looking at the land where the level probably will come, so that time will be saved in finding the proper point. In some localities

parties having farm levels go about laying out base lines for anyone in the community for a nominal fee. Where only a limited amount of work is to be done, it might be more desirable to employ

FIG. 4.—A homemade farm level.



them than to get an outfit. The secret of success consists in properly laying out the line as well as in final construction.

WOODEN SCRAPER FOR TERRACE BUILDING.

A homemade wooden scraper (fig. 5) which has been found very useful in terrace building may be made of the following materials:

1 piece lumber 2 by 12 inches by 12 feet.	2 bolts $\frac{1}{2}$ by 6 inches.
2 pieces lumber 2 by 4 inches by 12 feet.	4 bolts $\frac{1}{4}$ by $2\frac{1}{2}$ inches.
1 eyebolt and washer.	1 old crosscut saw.
2 bolts $\frac{1}{2}$ by 3 inches.	1 $\frac{1}{2}$ pounds 20-penny nails.

The 2 by 12 inch by 12-foot piece is sawed in half and the ends beveled so as to give a spread of 6 feet at the rear end. The two pieces of 2 by 4 inches are cut to make the braces and lever. The



FIG. 3.—A farm level and target.

bolts are used to fasten the two 2 by 12-inch pieces together at the bevel ends; the braces and lever are nailed in. On the outer, or wing side, the old saw is bolted on with the back flush with the lower edge of the 2 by 12 inch piece. The eyebolt is put in 1 foot from the end and 3 inches from the top of outer side of the builder.

How to use the scraper.—After the terrace line has been run with a level, the next step is to plow the ground to a width of 10 to 12 feet. The two center furrows should be lapped, and all other furrows should be thrown toward the center from both sides. Hitch the team to the eyebolt in the scraper and drive so that the side faced with the cross-cut saw will be the center of the terrace; the other side should fit

into the plow furrow and act as a landside. Regulate the height and distance of pitching the dirt by bearing down on the lever. Should the scraper wobble too much, additional weight is required and can be provided by a man standing on the scraper or by placing bags of soil on planks laid across the two top braces. A couple of rounds with the scraper should be sufficient to throw the terrace to the necessary height in the center. Then plow up the additional 3 to 5 feet and use this soil to dress down the sides of the terrace. One more round with the builder should suffice to finish the terrace and to leave it in good shape.

CONCLUSION.

Large areas in the cotton States are badly in need of some method of preventing the land from washing away. It is confidently believed that if this plan of broad terrace rows is adopted, with a wise system of crop rotation, the sandy hill lands may not only be held, but improved. After the people more fully realize the importance of caring for their lands, which are their most precious inheritance, it is hoped that they will adopt a better system of underground drainage, which doubtless will do away with the necessity for so much terracing.

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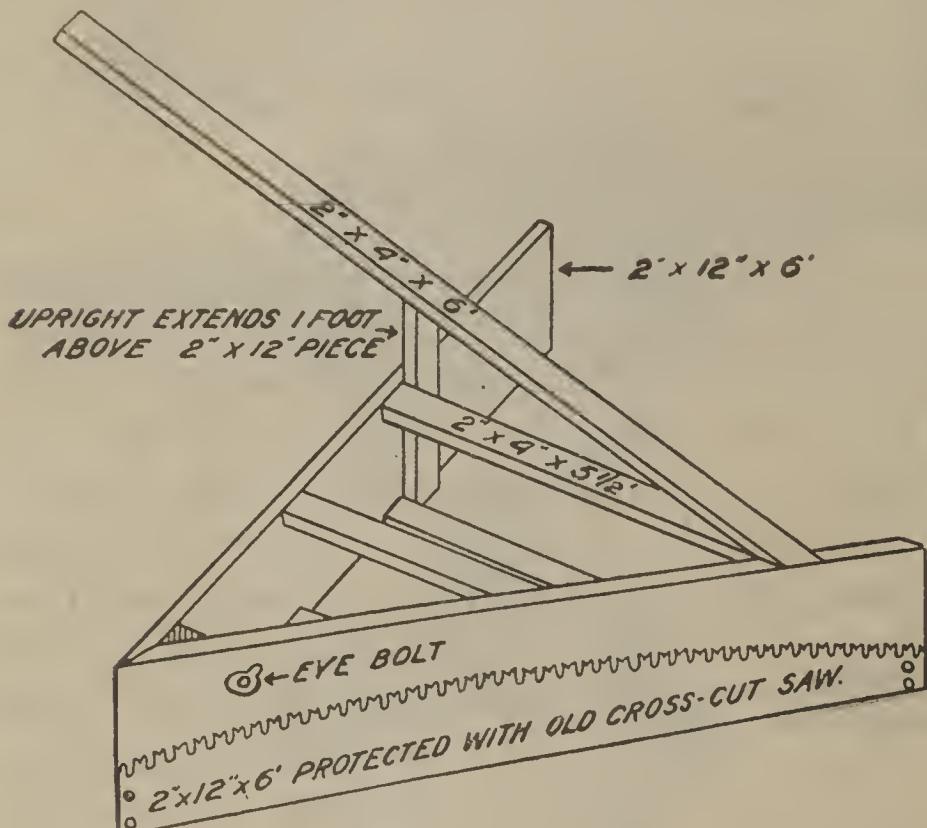


FIG. 5.—Wooden scraper for terrace building.